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NOTICES OF NEW BOOKS.

Die mechanistischen Grundgesetze des Lebens. Von ADOLF COHEN-KYSPER. Verlag Johann Ambrosius Barth, Leipzig, 1914.—pp. viii, 373.

This book is an attempt to explain the phenomena of life in terms of mechanics as formulated by Heinrich Hertz. It consists of an introduction and nine main subdivisions, of which seven are constructive, the others being devoted to a summary and a historical review.

Biology so far has, according to the author, proved itself incapable of meeting the problems of teleology—the capacity of living beings to maintain themselves under constantly altering conditions—and of development. The difficulty originates in the fact that the solutions have been attempted in terms of physics and chemistry, i. e., in terms of atoms and molecules, resulting in a search for the smallest material units which can act as bearers of life. The assumption is that since the alternate decomposition and rebuilding of cell material is a process peculiar to living tissue, the vital substance must consist of molecular units of peculiar structure and characteristics. Hence the end is to find laws of molecular dynamics which control the progress of life phenomena. Chemical procedure assumes the qualitative likeness of all parts of the system, any subdivision of which is capable of like effect with the whole. But the investigation of vital processes has tended to show they depend on a compounding of unlike molecular units. *Stoffwechsel* occurs on the basis of relationships involved in a higher system, the complete organ itself.

The failure of the materialistic school to solve the problems presented has led to vitalism. The task of the present work is to bring proof "that it is possible, without treading the ways of vitalism, and without remaining on the foundation of materialism, to handle life phenomena in an adequate fashion and to deal in a satisfactory way with the problems which conspicuously await their solution," etc. To do this, an attempt is made to subsume life phenomena under the laws of mechanics. The former are considered to represent the changes of position of a determined material system, the vital system, which take place on the basis of constant and regular *Zusammenhänge.* In Hertzian terms, when material points are so related that "from the knowledge of a part of the components of displacement of these points, a statement concerning the remaining components is possible" a *Zusammenhang* exists between them. The character of the *Zusammenhänge* of any particular system is a matter to be determined by experience. The sum of the regular *Zusammenhänge* is the dynamic of the system. The movements executed on this basis are the dynamic renderings of the system or its function, the initiating of which is known as acceleration. The smallest vital system or dynamic unity, i. e., the smallest system that can sustain life, is the cell. Organisms are merely integrated systems, or more complex structures, whose functioning is dependent on the activity of all the cell elements and organs. The only difference between dead and living nature lies in the complexity of the integrated units found in the two spheres. Granted that the cells and organisms are the dynamic units of the vital systems, a mere description of their processes as given in experience should lead to an understanding of these as mechanical and show the underlying laws. These processes are to be divided into (1) those connected with development and regeneration, and (2) those in which the developed system acts on external stimuli.

Of the latter we note the functioning of an organ in response to external stimuli, where the strength of the function varies directly as the stimulus, and on the disappearance of the latter, the system returns to its initial condition. Also if any function is to be repeatedly realized, the totality of the inner relations of the system, its construction, must be maintained. We get thus the concept of the construction equilibrium which seems to mean that any given organism, if it is to function, must be so constituted as to be able to respond to the external influences to which it is normally subject without fundamental alteration. Changing outside conditions are generally met within the limits of a given construction by mutual regulation of the several functions of the parts of the system, though sometimes by an alteration of the structure itself. All these cases show that the reaction to the external stimulus is in the form of the maintenance of or a return to a condition of equilibrium. The author here notes a very significant fact. The physicist has no interest in the continued equilibrium of a system in the present sense, it being a matter of indifference whether the material system with which he is dealing persists or is transformed into another. But for vital mechanics the maintenance of the system is the fundamental problem, and its task is to find the general mechanical laws on the basis of which the phenomena of equilibrium can be explained. Does not this difference raise a suspicion that vital systems are quite different from dead?

We can distinguish three stages in the whole process, an acceleration due to an external force, a retarding of this acceleration by means of the inner relations of the organism known as the *Zwang* of the organism, and the final achievement of a state of equilibrium. The *Zwang* is to be considered as a case of Newton's first law. The achievement of equilibrium falls under the principle that the inner acceleration due to the *Zwang* of the system is at any moment the least which is compatible with bringing the disturbance to zero. We finally get the law that the equilibrium of a material system with an outer force is achieved in the shortest way consistent with the given conditions, which at least as far as vital systems are concerned is an assumption.

After showing with considerable success how these concepts apply to the dynamics of the cell, in the course of which presentation the unitary character of the latter in the carrying out of the various activities, especially cell division, is emphasized, the author attempts to grapple with the problem of consciousness. He recognizes that consciousness is primarily a tool for utilizing the results of past experience as a means of adjustment to varying conditions. Viewing consciousness as a function of the nervous system, we can consider the latter as a mechanical system, and hence state the mind in terms of physics. This is of course a *petitio principii*, as is the assertion which is made elsewhere that living systems arise by a process of integration from dead. The author then gives a typically associationalistic and atomistic account of mental phenomena, in which memory, association, conception, judgment and even inference are regarded as forms of reaction built up in the establishing of a state of equilibrium with an obtruding world. Space forbids details, but the account is, as always happens, quite unsatisfactory.

Finally we come to development, both ontological and phylological. The fundamental fact about all development is that we always end with a system similar to the one with which we started. This has led to the idea of the continuity of the germ-plasm, *i. e.*, of material continuity. Ontological development is normally looked upon as a function of substances, not of an organized system. Here Cohen-Kysper sees in it, on the other hand, a process which represents the attempt of a certain organic unity (generally the germ cell), to restore its disturbed equilibrium. A system capable of developing an organism is an *Entwicklungspotential.* Its condition at any moment of the process is a phase. The specific character of the resultant organisms is to be accounted for on the basis of the fact that the nature of all germ cells is specific. By a further law, to the effect that when a system which has reached a certain stage in its development is removed from the conditions normally existing at this stage it returns to its initial phase from whence it completes the development, we can understand the phenomena of "Fortpflanzung durch Knospen, die Erscheinung des Generationswechsels, die Stockbildung niederer Tiere," regeneration and allied phenomena. This is the "*Gesetz der Rückkehr zur Ausgangsphase.*"

But how has any specific *Entwicklungspotential* come to be, *i. e.*, what is the process of evolution? Organisms themselves can only in a limited way be regarded as the carriers of the process, for they are constantly being destroyed while phylogenetic development is continuous. The bearer of the development is then the *Entwicklungspotential* of an organism and the organism only participates in so far as its changes influence the latter. Every alteration in evolution is to be regarded as a change in the *Entwicklungspotential* brought about either directly through external influences or through the reflecting back on the germ-plasm of alterations in the somatic parts of the organism itself. In the course of adjustment to the altering conditions, which is nothing but a method of restoring the disturbed equilibrium, the germ cells receive a permanent transformation, provided the change occurs often. New organs and their functions represent restored equilibrium in the presence of external stimuli. That the restoration of equilibrium should take place through integration is a specific property of the peculiar systems which are living beings.

One great point in favor of the views here advocated is to be noted—the abandonment of the attempt to understand life phenomena on the basis of the material of which organisms are composed, and to substitute for this the study of living forms as structures or systems. Such a view may or may not lead to an explanation in terms of the ordinary concepts of physical science. But if this further consequence is not realized, still to understand the actual functions in terms of the complex structure itself seems the only method of rendering intelligible the whole field of animal behavior. Jennings seems to have come to some such conclusion. On the other hand, the attempt before us progresses but little in the direction of elucidating the vital processes. The application of certain concepts, like equilibrium, change of position, inertia, etc., in the latter is only significant provided it really renders the activities more intelligible in the sense that it gives us insight on the basis of which further definite facts may be anticipated and sought, and is not a mere transference of terms. The latter seems to be the case here. To call growth an attempt to restore equilibrium is valid enough in a sense, but it adds nothing to our concrete grasp of the details of the situation. And such hypotheses are sterile.

Many less important details could be added to our criticism. The account of mind is of course quite inadequate and hence vague. Also the apparent advocacy of the inheritance of acquired characteristics is at present quite unwarranted. And the whole work fails to show how on the basis adopted the differences between organisms which can learn and systems which can not, *i. e.*, how the results achieved by the study of animal behavior such as those of Jennings, are to be accounted for. Unwarranted assumptions are also frequent.

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The Theory of Relativity. By L. SILBERSTEIN. Macmillan and Co., London, 1914.—pp. viii, 295.

This scholarly and carefully written book is intended as an introduction to the recent development of physics known as the theory of relativity. The author presupposes on the part of the reader advanced knowledge of mathematics, such as vector analysis, and a considerable acquaintance with such branches of physics as electro-dynamics, etc. It is thus primarily a book for mathematical physicists. If the philosopher, however, is willing to descend from his architectonic heights and become a humble learner from a modest but competent and conscientious investigator, he is likely to receive much illumination concerning the meaning of such prevalent ideas as the laws of nature, time, space and causality. It is not that the author, like some other expositors of the newer theory of relativity, enters the lists in the fight against traditional ideas of physics. Dr. Silberstein is not inclined to emphasize the revolutionary character of the new ideas, but is rather concerned to show their intimate connection with the older ones. But, in spite of the fact that he is not concerned with the traditional problems of the philosophy of nature, anyone who follows his careful analysis of the ideas involved in the classical mechanics and their modification suggested by recent experimental work must realize